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SURFACE TEMPERATURE DISTRIBUTION ANALYSIS USING REMOTE SENSING SYSTEM IN SPERMONDE ESTUARY

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ABSTRACT

Research on the phenomenon of climate change on the region Makassar Strait waters that are part of the oceanographic activities that require observation of the sea surface temperature (SST), surface currents and ocean color imagery from satellite imagery. In this case, satellite remote sensing data using Aqua-Modis analyze both visually and raw-surface temperature parameter data in order to study a variety of other related phenomena that take place in the ocean. The existence of satellite imagery data for the observation of parameters and / or oceanographic phenomena will be more profitable in terms of time and cost and high accuracy. The purpose of this study was to review based on the description of the SST analysis using Aqua-Modis image data (non-commercial) and open source software in providing the information cepatdan applicable. Bodies Spermonde been considering the seas is quite unique because it is located right in the path of the current meeting of the Pacific Ocean through the sea of Sulawesi and spacious enough for the continuity of mesoscale oceanographic processes for coverage in the waters Spermonde in (islands) Indonesia.

Keywords: Remote Sensing System, rivers Tallo, Sea surface temperature, Kappoposang, chlorophyll-a, micro-algae

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1. INTRODUCTION

Remote sensing system (RSS) has the ability to identify and monitor the changing environment and marine coastal areas. Sea surface temperatureis very important because it is the power of the sea that can distribute materials, either dissolved or suspended in the water from one place to another. Therefore, the current can be a positive influence on marine life and also can be a negative effect if carried by the currents are contaminants that can damage the ecosystem[1] - [3], Contributions to the impacts of climate change by developed countries yet to show significant results because this is based on the reduction of

CO2 emissions as a source of global warming is still a persuasive efforts of developing countries. The impact of the reduction of CO^2 gas has not given good results for the reduction of greenhouse gases, it is because the carrying capacity of tropical countries as a source of decline in world temperatures are not able to maintain below 20% in accordance with the agreement at COP-15 in Copenhagen. Many obstacles that cause carbon compounds easily escape into the atmosphere. Speaking of climate change, not just CO^2 that have a big impact, but there are also other elements that are also very influential among hydrocarbons and sulfur.[4].

In 1972, a hypothesis provides basic views on the relationship between micro-algae feedback and climate [5], [6], Claw hypothesis suggests that, no natural ability to recover through the influence of solar radiation to the Earth to the density of the cloud condensation nucleus as a source of raindrops, and as the main source over the ocean is Dimethylsulfida (DMS), [7] - [9] Algae (phytoplankton) is biologically contribute as climate regulation through the effects of temperature and sunlight, [2], [3], [10], [11],

Over the past two decades, there has been concern about the effects of greenhouse gases produced by human and other environmental pollutants on the Earth's climate. These changes predicted by climate models, which are also used to change the project into the next century. Satellite data records started quite a long time to evaluate changes in multi-decadel. These changes can be examined for evidence of climate change, and is used to see if the climate models can do a good job when used to "predict" the changes that have occurred.

In order to generate the data record is long enough to study climate change, measurements from different satellites to be intercalibrated with one another and then combined together into a single record. Compared with in situ measurements, the main advantage of satellite data records from polar orbiting satellites are almost complete global coverage and data quality homogeneous. In situ data record is quite rare in the area located far from the industrialized countries, which concentrated on the land mass in the northern hemisphere and perselatanan latitude. For example, there was a bit of a weather balloon launched in the Eastern Tropical Pacific Ocean, although this region is where the Sea Surface Temperature changes due to El Nino - Southern Oscillation cycle greatest [9],

Climate is the average weather in a certain location, the average over a period of time long enough, at least 10 years. When we talk about the climate, we often talk about the values of the average meteorological or oceanographic variables, such as temperature, precipitation, humidity, wind speed or the sea temperature at a particular location at a particular time of year. If climate change from time to time, can directly affect human activity by changing the crops that can be grown, fresh water supply, or the average level of the sea. It can also affect natural ecosystems, causing deserts to expand, forest fires are becoming more common, or permafrost melt.

Below, we discuss some of the basic climate results obtained using the Microwave Data Remote Sensing System, and discuss some of the climate-related rese arch that has been carried out.

a. The temperature of the atmosphere

View on Water Temperature Measurement page for details on how the temperature of the atmosphere generated dataset. Here we present the application of this dataset for analysis of climate change. (Note: This section was updated on June 30, 2017 up to include the results of TLT Version 4.0)

b. Tropospheric temperature

There are three troposphere temperature dataset available from the RSS, TLT (lower troposphere temperature), TMT (South Temperature troposphere), and TTT (Temperature Total troposphere, after Fu and Johansen). Using this dataset, we can investigate whether there had been significant changes in tropospheric temperature over the last 35 years, and whether or not the spatial pattern of these changes agree with those predicted by the climate models.

Over the past decade, we have worked closely with Ben Santer at LLNL (along with many other researchers) to compare the results of our troposphere with climate model predictions. Our results can be summarized as follows:

• Over the past 35 years, the troposphere has warmed significantly. Global average temperature has risen at an average rate of about 0.18 degrees Kelvin per decade (0.32 degrees F per decade).

• Climate models can not explain the warming is caused by humans if it increases greenhouse gases are not included as input to the simulation model.

• The spatial pattern of warming is consistent with warming is caused by humans. See Santer et al 2008, 2009, 2011, and 2012 for more on detection and attribution of human-induced changes in atmospheric temperature using the data MSU / AMSU.

• Troposphere has not warmed sufficiently fast as most climate models predict. Note that this problem has been reduced to a great 2015-2106 El Nino event, and the latest version of RSS dataset troposphere.

2. MATERIAL AND METHOD

Materials

This study is located in 119^{o}26'34.5 "N - 118^{o}58'04,0" and -05^{o}05'39.4 "E - 04^{o}42'08,6" E (Figure 1). The materials used in this activity is data-Modis Aqua satellite imagery in the form of SST for the month of January to December 2017.

The data accessed at:http://oceancolor. gsfc.nasa.gov, Various types of data available can be downloaded for free, but for the purposes of this study the data used are SST level-3 with a resolution of 4 km. The equipment required in the activities is a microsoft windows 64 bit computer as well as software Seadas 7.5.1 version.

Radiometric distortion caused by the influence of atmospheric scattering and absorption, refraction at the time of data transmission, optical condition sensor and the light changes require repair radiometric and spectral quality of the image. Based on the nature of the data which is a composite of data and ready to use, then the data SST level-3 does not require stages of both geometric and radiometric correction.

Figure 2. Location of research and Area of Interest (AOI) is divided into Outer Zone and Inner zone.

Therefore, in the event of radiometric correction was not done because of the imagery used is a 3-level data that have been corrected both geometric and radiometric. Step cuts the image (image cropping) is done to minimize the image display area corresponding coordinates of the desired area. It aims to be a smaller file size so that the processing becomes faster. For the sake of comparison data observations were made by making the area of interest (AOI) are differently shaped outerzone 1 and outerzone 2. Second outerzone as this AIO each have the same size for the area and perimeter, ie 16666.81 km^2 (wide) and 516.387624 km (around). Each outerzone has a location; 119°26'34.5" E - 119°21'39.6" E latitude and -05°05'42,3" N - -05°01'43.4" N atitude for the location inner zone and 114°05'07.1" E - 118°58'04.0" E latitude and -04° 58'16.4" N – -04°46'08,6N" atitude for the location inner zone (Figure 1). The intention of making this outerzone is to observe the pattern / profile surface temperatures are expected to represent a metaphor for the condition of the surface temperature of the semi enclosed / the bay is relatively homogeneous (outerzone 1) with different conditions in the semi-open / forward or outside the bay is relatively dynamic to the effects of wind and current (innerzone). Data on average monthly surface temperature distribution during the year (12 months) was then extracted from Modis image for each outerzone. In the extraction stage, initial data obtained is shaped kompresan with .bgz format, therefore the required stages of conversion to be extracted in the form .hdf file format. In the form of file format. This hdf SST Data can already be cut and processed at Seadas for further use in visualize (display) and analysis (raw data) for the surface temperature observation activities. Especially for the purposes of the analysis of raw data, surface temperature data dikonver again into ASCII format for further processing in MS Excel into representasi graphical (chart) distribution of surface temperatures monthly for each area that represents the waters of semi-enclosed (outerzone) and open (innerzone 2).

3. RESULT AND DISCUSSION

The results are composite processing (image) and analysis of raw data is represented in the form SST. SST distribution patterns shown in Figures 2 and 3. In Figure 2, output data processing result SST made in png format. Data processed include Spermonde Bodies of water area and its surroundings, including the outerzone representing the inside and outside the territorial waters of the bay area. In Figure 3 shows the results of the analysis of raw data such as SST values in degrees Celsius (Co) in each outerzone.

Generally seen as a color composite of a visualization surface temperature distribution patterns are different between semi-closed water area (inside the bay / outerzone 1) that its surface temperature is relatively high compared tend to dominate the semi-open area (outside bay / outerzone 2) on the observation throughout 2017. By the analysis of raw data to the surface temperature further clarify what is shown in Figure 2 as shown in Figure 3. Some of the factors that affect the temperature of the surface in between; season conditions (climate), winds, and the phenomena that occur at sea as*upwelling*, Current, and others. Related to this, the climatic conditions of the region Bodies Spermonde heavily influenced by eastern and western season (Infocom South Sulawesi, 2017).

According to the Bureau of Infocom Sulawesi South, (2017) that is common in eastern season from April to September, while the west season usually lasts from October. If combined with the observations in this study, it can be observed that the phenomenon of seasons affect the temperature of the surface waters of Aquatic Spermonde. East monsoon affects the surface temperature at the water declining Spermonde Water well in the door or waters (outerzone and innerzone). The opposite occurs in the western influence on the increase in the average temperature of the surface waters Spermonde Bodies, as shown in Figure 3. Based on the distribution pattern of sea surface temperature imagery viewable oceanographic phenomena such as upwelling, front, and the pattern of surface currents. Area having phenomena as mentioned above is generally a fertile waters. By knowing the water area is fertile then the fishing area [1], In addition, the temperature can affect the photosynthesis in the ocean either directly or indirectly. Direct influence which acts to control the temperature of enzymatic chemical reactions in photosynthesis. High temperatures can increase the maximum rate, while indirectly influence in changing the photosynthesis (Pmaxstruktur hydrology water column that could affect the distribution of phytoplankton [2], In general, the rate of phytoplankton photosynthesis increases with increasing temperature of the water, but it would be significantly reduced after reaching a certain temperature point. This is because each species of phytoplankton always adapt to a certain temperature range.

Differences in surface water temperature can cause the flow of ocean currents on the surface. By paying attention to the temperature distribution map Spermonde Bodies of surface waters during 2017, as well as a few locations that could be clues to the location fronts and upwelling also mass flow of surface water can diinterprestasi based visualization of surface water temperature gradient throughout the year (Figure 2). As the waters in the tropics and is right on the equator, throughout the year, generally water surface temperature conditions Bodies Spermonde tend to warm (29o - 31o C). However, in some locations can be seen raising the temperature water up to 33^{o}C. A different picture can be found in comparing the conditions between the surface temperature distribution inside and outside the bay area. The phenomenon of surface temperature gradient decrease drastically around the area outside the waters of the bay is probably caused by upwelling process [1],

Rapid, inexpensive and efficient use of the image data has been demonstrated in this activity for the purposes of observation and analysis of sea surface temperature as one of the important parameters in oceanographic processes. For the purpose of administering the field of marine and fisheries, sources of data and information efficiently and effectively supported by the data type that is inexpensive, fast, and wide range of course is a necessity given the vast area of ocean that is owned by the Republic of Indonesia that is useful for management of both regional and national or International.

To illustrate this last issue, we show you some plot below. Each plot has a temperature anomaly time series TLT using the reference period of 1979-2008. On each plot, a thick black line is the result of the latest version of the satellite dataset RSS. Yellow band indicates 5% to 95% of the envelope for the results of 33 CMIP-5 simulation model (19 different models, many with some realization) that is intended to simulate the Earth's climate during the 20th century. For periods prior to 2005, the model was forced with historical values of greenhouse gases, volcanic aerosols and solar output. After 2005, the projected plunger is used. If the model, on the whole, do the work received from the simulated past, then observations will mostly be in the yellow band.

At the table 1. About the comparison of contributions of contributors to sulfur gas in the anthropogenic, biogenic and volcanic atmosphere.

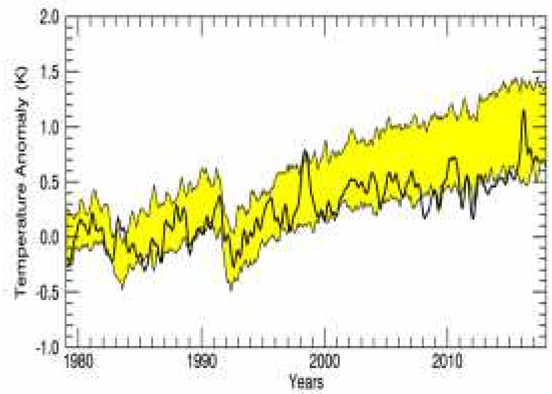

Figure 2. Global (70S to 80N) means TLT Anomaly is plotted as a function of time. The black line is the time series for the MSU RSS V4.0 / AMSU atmosperhic temperature dataset. The yellow band is in the range of 5% to 95% of the output from the climate CMIP-5 simulation. The average value of each average series from 1979-1984 is set to zero so that changes over time can be seen more easily. Note that after 1998, observations tended to be at the bottom of the distribution model, indicating that there were small differences between the model predictions and Satelllite observations. (All time series have been refined to remove variabilty on a time scale shorter than 6 months.)

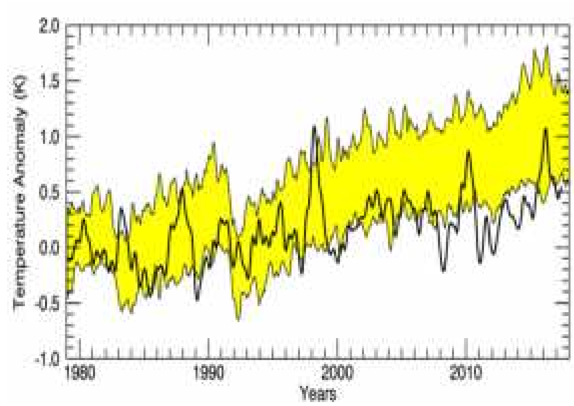

Figure 3. Tropical (30S to 30N) Means TLT Anomaly is plotted as a function of time. The black line is the time series for

MSS RSS V4.0 / AMSU atmosperhic temperature datasets. The yellow band is in the range of 5% to 95% of the output from the climate CMIP-5 simulation.

Why does this difference exist and what does it mean? One possible explanation is the error in the basic physics used by climate models. Apart from this possibility, there are at least three other plausible explanations for differences in heating rates. There are errors in forcings used as inputs for model simulations (these include drivers due to anthropogenic gases and aerosols, volcanic aerosols, solar inputs, and ozone changes), errors in satellite observations (partially handled using ensemble uncertainty), and sequences of internal climate variability in simulations that are different from what happens in the real world. We call these four explanations "error physics models", "error input models", "observation errors", and "different variability sequences". They are not mutually exclusive. In fact, there is difficult scientific evidence that these four factors contribute to these differences, and that most can be explained without a model of physical error.

For a detailed discussion of all these reasons, look at the skeptical Science blog by Ben Santer and Carl Mears, and recently a paper in Nature Geoscience by Santer et al.

1. Stratosphere Temperature

Lower stratospheric temperatures have been monitored since late 1978 by MSU and AMSU instruments. RSS combined products that have lower stratospheric data temperatures are called TLS, or lower stratospheric temperatures. In contrast to the troposphere, which warms slowly during this period, the lower stratosphere has cooled because both decreases in stratospheric ozone are caused by CFCs, and increased mixed greenhouse gases cause human activity. This slow cooling tendency is interspersed occasionally with a temporary increase in stratospheric aerosols caused by large volcanic eruptions. In the plot below, we show global average temperature anomalies from RSS TLS data, and 5% to 95% envelopes from historical simulation CMIP-5.

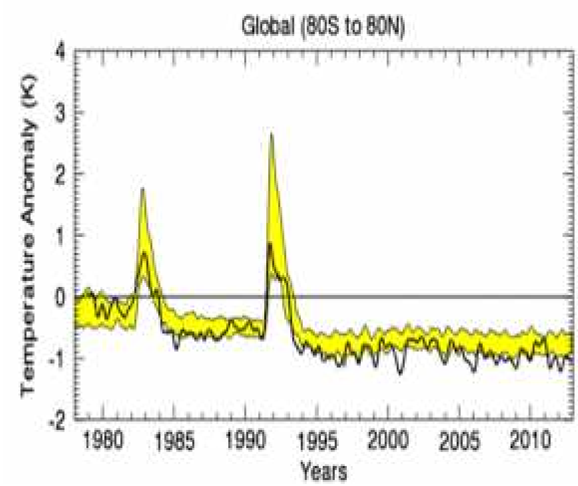

Figure 4. Global (80S to 80N) Means TLS Anomalies are plotted as a function of time. The thick black line is the time series observed from RSS V3.3 MSU / AMSU Temperature. The yellow band is in the range of 5% to 95% of the output from the CMIP-5 climate simulation. The average value of each series of averages from 1979-1984 is set to zero so that changes over time can be more easily seen.

The basic features of changes in stratospheric temperature are captured by the model, although some models appear to show too much response to volcanic eruptions and also appear to show too little overall cooling.

2. The Amount Of Water Vapor Column

Over the ocean, we can monitor the magnitude-decadal changes in the total amount of water vapor in the atmosphere using steam combined product, which is derived from measurements made by SSM / I, SSMIS, AMSRE, and WindSat. For a description of this dataset, see Measuring water vapor atmosphere. As the earth warms the troposphere, he was able to "hold" more water vapor without steam condensing into clouds and then rain. Assuming the relative humidity remains constant, the amount of extra water vapor is governed by the Clausius-Clapeyron relationship, and about 7% more water vapor per degree Kelvin temperature rise. The global rise in water vapor is easy to see in Figure 5, which shows the average global time series total column water vapor over the oceans of the world, expressed in percent change from the average.

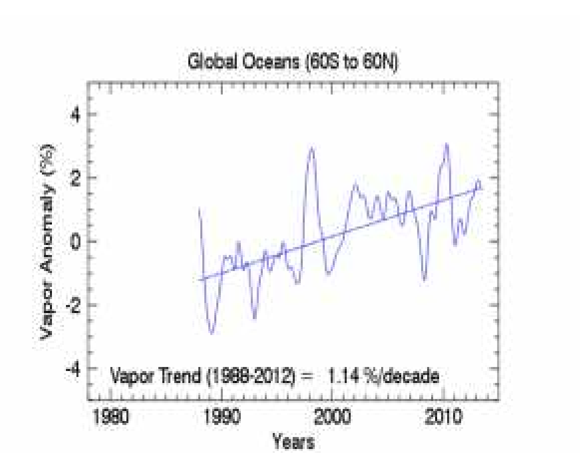

Figure 5. Time series total column vapor anomaly, averaging over the world's oceans, from 60S to 60N.

This increase can be formally attributed to human-caused climate change - see Santer et al, 2007. Although there was an overall increase substantially in moisture, it does not mean spatially uniform. Figure 6 shows a map of the water vapor trends over the period 1988-2017.

While most of the world shows the wet to varying degrees, there is a very large drying area in the south of the tropical Pacific Ocean on both sides of the equator. Trends in water vapor, either positive or negative, which leads to this pattern almost all statistically significant compared with the estimate of the error in the trend of water vapor.

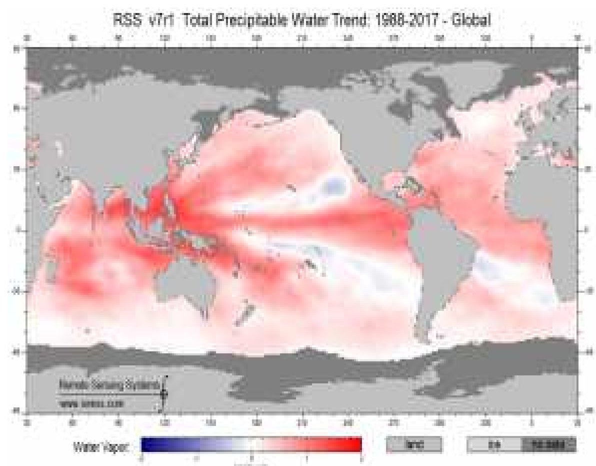

Figure 6. Maps of Trends column water vapor, for the period 1988-2017.

In the deep tropics, changes in water vapor that are very strong correlate with changes in atmospheric temperature. Figure 7 shows the time series of water vapor and anomalous temperatures from different satellite temperature datasets. Data that has averaged over the ocean in latitude bands from 20S to 20N.

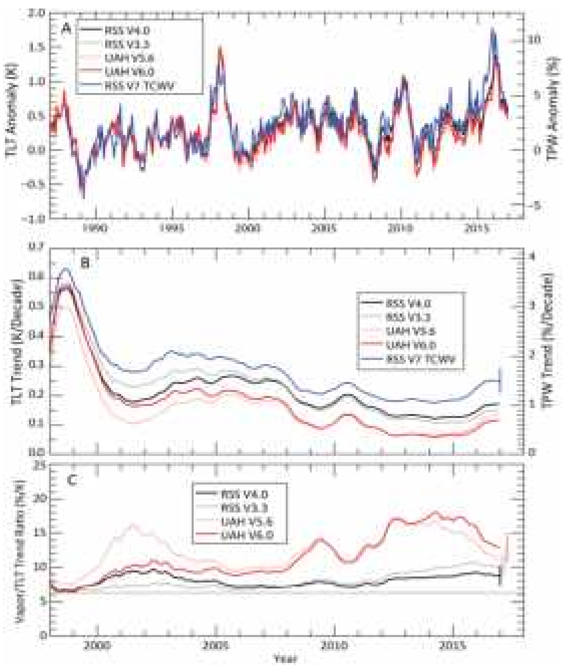

Fig 7. Time series total column vapor anomalies and temperature anomalies, the average over the world's oceans, from 20S to 20N. The top panel shows the time series. Southern panel shows the trend goes, starting in January 1988, and ends at the time on the x-axis. The bottom panel shows the trend of the ratio of steam to the trend of TLT. Climate models indicate that this ratio should be around 6.2% / K. All combination of satellite data showed a larger ratio, showing that both measurements show moistneing too much, or too little heating. The latest version of the dataset RSS TLT closest to expectations ..

4. CONCLUSION

Rapid, inexpensive and efficient use of the image data has been demonstrated in this activity for the purposes of observation and analysis of sea surface temperature as one of the important parameters in oceanographic processes. For the purpose of administering the field of maritime affairs and fisheries, sources of data and information efficiently and effectively supported by the data type that is inexpensive, fast, and wide range of course is a necessity given the vast area of ocean that is owned by the Republic of Indonesian that is useful for management both regional and national, or even international.

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REFERENCES

[1] M. O. Andreae, ‘Ocean-atmosphere interactions in the global biogeochemical sulfur cycle’, Mar. Chem., vol. 30, pp. 1–29, Jan. 1990.

[2] A. C. Baker, P. W. Glynn, and B. Riegl, 'Climate change and coral reef bleaching: An ecological assessment of long-term impacts, recovery trends and future outlook', Estuar. Coast. Shelf Sci., Vol. 80, no. 4, pp. 435-471, Dec. 2008.

[3] X. Zhai, H.-H. Zhang, G.-P. Yang, J.-L. Li, and D. Yuan, 'Distribution and sea-air fluxes of biogenic gases and

relationships with phytoplankton and nutrients in the central basin of the South China Sea during summer', Mar. Chem., Vol. 200, pp. 33-44, Mar. 2018.

[4] JM Wallace and PV Hobbs, '10 - Climate Dynamics', in Atmospheric Science (Second Edition), San Diego: Academic Press, 2006, pp. 419-465.

[5] T. Lenton, 'GAIA Hypothesis A2 - Holton, James R.', in Encyclopedia of Atmospheric Sciences, Oxford: Academic Press, 2003, pp. 815-820.

[6] L. Levine, 'GAIA: Goddess and ideas', Biosystems, Vol. 31, no. 2, pp. 85-92 go, Jan. 1993.

[7] RT Barber, 'Ocean Ecosystems A2 - Levin, Simon A ', in Encyclopedia of Biodiversity (Second Edition), Waltham: Academic Press, 2001, pp. 581-589.

[8] H. Palanisamy, A. Cazenave, B. Meyssignac, L. Soudarin, G. Wöppelmann, and M. Becker, 'regional variability of sea level, the total relative sea level rise and its impacts on islands and coastal zones of Indian Ocean over the last sixty years ', Glob. Planet. Change, vol. 116, pp. 54-67, May, 2014.

[9] R. Simo, JO Grimalt, and J. Albaigés, 'Dissolved dimethylsulphide, dimethylsulphoniopropionate and dimethylsulphoxide in western Mediterranean waters', Deep Sea Res. Part II Top. Stud. Oceanogr., Vol. 44, no. 3, pp. 929-950 go, Jan. 1997.

[10] I. Barnes, 'Tropospheric CHEMISTRY AND Composition | Sulfur Chemistry, OrganicA2 - North, Gerald R. ', in Encyclopedia of Atmospheric Sciences (Second Edition), J. Pyle and F. Zhang, Eds. Oxford: Academic Press, 2015, pp. 255-264.

[11] L. Zhou, B. Tinsley, H. Chu, and Z. Xiao, 'Correlations of global sea surface temperatures with the solar wind speed', J. Atmospheric Sol.-Terr. Phys.

[12] M. Breulmann, T. Boettger, F. Buscot, Gruendling R., and E. Schulz, 'Carbon storage potential in the size-density fractions from semi-natural grassland ecosystems with different productivities over varying soil depths', Sci. Total Environ., Vol. 545-546, pp. 30-39, Mar. 2016.

[13] Adnan, 'Analysis of Sea Surface Temperature and Chlorophyll-A Sensing Data Relation to Catch Fish Tuna (Euthynnus affinis) in East Kalimantan Bodies', Amanisal, vol. 1, no. 1, pp. 1-12, 2010.

[14] MJ Risk and MV Erdmann, 'Isotopic Composition of Nitrogen in Stomatopod (crustacea) Tissues as an Indicator of Human Sewage Indonesian Impacts on Coral Reefs', Mar. Pollut. Bull., Vol. 40, no. 1, pp. 50-58 go, Jan. 2000.